



PHYSICS

BOOKS - PEARSON IIT JEE

FOUNDATION

MEASUREMENTS

Example

1. Write the dimensional formula of speed.



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2. What is the dimensional formula of force ?

A. $[MLT^{-3}]$

B. $[ML^2T^{-2}]$

C. $[ML^2T^{-3}]$

D. $[MLT^{-2}]$

Answer:



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3. While measuring the diameter of a sphere with a vernier callipers M.S.R and V.S.D. are 35 mm and 5 respectively . If the vernier scale coinciding with 19 division of main scale what is the diameter of the sphere?



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4. When the jaws of a vernier callipers are closed the 0th division of its vernier scale is to the right of the zero of the main scale and the V.S.D is 6 .Find the correction to be made to

the observed measurement (take its least count as 0.1 mm)



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Very Short Answer Type Question

1. Define relative density



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2. The value of $G=6.67 \times 10^{-11} Nm^2 kg^{-2}$ and $g = 9.8ms^{-2}$.

The unit of g/G in C.G.S system is _____



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3. The number of significant figures in 10.02 is _____

A. 3

B. 6

C. 0

D. 4

Answer: 4



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4. What is the principle of working of a physical balance ?



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5. What are the C.G.S. and S.I. units of area ?

Give the relationship between them.



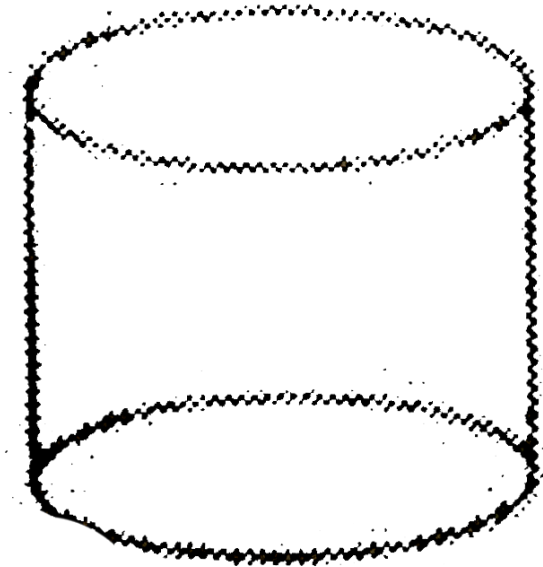
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6. the smallest measurement than can be made accurately by an instrument is called



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7. A rectangular metal sheet of area 2 m^2 is rolled to a cylinder of volume $(4/\pi)\text{m}^3$. The radius of the cylinder thus formed is _____ m



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8. What is the least count of a standard screw gauge



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9. Define significant figures.



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10. In a standard vernier callipers 'N' vernier scale division are equal to _____ main scale

divisions



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11. Name the different parts of a screw gague



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12. If the energy of a photon is given by

$E = \frac{hc}{\lambda}$, where h is the Plank's constant c is

the velocity of light and λ is the wavelength of

the radiation then the unit of Planck's constant is _____

A. Jm^2 / s

B. m / Js

C. Jm

D. Js

Answer: D



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13. The distance between the two consecutive threads of a screw is known as the _____ of the screw.



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14. What is the principle of a screw gauge



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15. Define light year.



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16. The time taken by a second pendulum to go from one extreme end to the other is



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17. define the pitch of a screw.



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18. Area and volume are not _____ quantities

A. derived

B. fundamental

C.

D.

Answer:



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19. If the length of a vernier scale having 25 divisions correspond to 23 main scale division and given that $1\text{M.S.D} = 1\text{ mm}$ the least count of the vernier calipers is _____



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20. the diameter of a wire was measured as 1.65 mm with a certain faulty screw gauge when the correct diameter was 1.60 mm. what

type of error does the faulty screw gauge have?



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21. Define the least count of a vernier calliper.



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22. If surface tension is defined as force per unit length then the dimensional formula of surface tension is

A. $[M^1 L^0 T^{-2}]$

B. $[M^2 L^2 T^{-2}]$

C. $[M^1 L^2 T^{-2}]$

D. $[M^0 L^1 T^{-2}]$

Answer: A



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23. Define density.



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24. Define resting point and zero-resting point.



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25. The time periods of two simple pendula having different length is the same on two different planets .if the lengths of the two pendula are in ratio of 1:9, then the ratio of the accelerations due to gravity on the two planets is _____



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26. What is the principle of vernier calipers?



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27. The diameter of a rod as measured by a screw gauge of pitch 0.5 mm is 8.3 mm . The pitch scale reading is _____



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28. Define

(a) solar day

(b) Mean solar day.



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29. If the length of a seconds pendulum on a planet is 2 m then the acceleration due to gravity on the surface of that planet is _____

(Take the acceleration due to gravity on the surface of the Earth $= 9.8 \text{ m.s}^{-2}$)





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30. What is meant by degree of accuracy ?



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Shor Answer Type Question

1. State the rules used for significant figures while rounding off the digits.



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2. What are the precautions that should be taken while using a physical balance?



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3. Discuss the zero error of a vernier callipers and state how it can be corrected.



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4. Describe a method to find the density of an object that is lighter than water.



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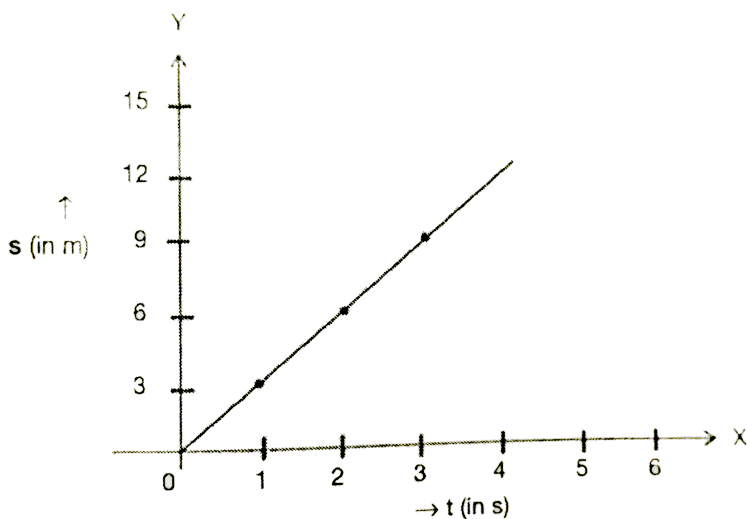
5. A vernier calliper has 20 division on vernier scale and its M.S.D is 0.5 mm .when a hollow cylinder is held by its internal jaws the M.S.R and V.C.D of callipers are 1.2 cm and 10, respectively .Find the radius of cross section of the cylinder.





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6. Define least count. Describe the method to find the least count of a screw gague.



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7. A displacement -time graph of a body moving with uniform velocity is shown in the figure. Find out its velocity and its displacement at the end of 5 seconds



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8. Write the expression for pitch and least count a screw gauge.



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9. Discuss the type of zero errors in vernier callipers ?



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10. The head scale of a screw gauge has 200 divisions . Its head advances by 1 mm for 2 complete rotations of its head . Find its pitch and least count.



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11. Describe briefly the method to determine the density of an irregular body.



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12. A screw gauge has a positive error of 4 division .When this screw gauge hold's sphere the main scale reading is 4 mm and the head scale coincinding division is 24 . If its least count is 0.01 mm find out he the volume of the sphere.



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13. Draw a neat sketch of a screw gauge .
Discuss the positive and negative zero errors
in a screw gauge and their corrections.



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14. What is the effect of combining errors?



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1. Explain the principle of a screw gauge and explain the method of determining the diameter of a wire .



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2. State the rules for determining the number of significant digits for addition and multiplication .Give examples?



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3. Describe an experiment to find the volume of a sphere using vernier callipers.



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4. Describe a method to determine the mass of a body using a physical balance.



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5. Draw a neat sketch of a physical balance and name the various parts.



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Level 1

1. A simple pendulum can be used to determine acceleration due to gravity at a given place.



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2. If the zeroth division on the vernier scale and the main scale do not coincide when the jaws are in contact then there exists an error.

A. True

B. False

C.

D.

Answer: True



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3. If p is the pitch of a screw then the distance by which the screw advances when given n rotations is $\frac{p}{n}$.

A. True

B. False

C.

D.

Answer: False



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4. If the percentage error in the measurement of length and breadth of a rectangle are 2% and 3% respectively then the percentage error in the determination of the area is 5%



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5. Velocity gradient is defined as 'change in velocity per unit distance'. Then its unit in E.P.S system is s^{-1}



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6. $10^6 \mu\text{m}$ are equal to one metre.



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7. The least count (the minimum weight that can be weight) of a physical balance is one gram.

A. True

B. False

C.

D.

Answer: False



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8. In a spring balance the extent of a pull of spring is _____ to the magnitude of the weight (force) applied on it.



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9. If N divisions on the vernier scale are equal to $(N-2)$ divisions on the main scale then the least count is _____



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10. The order of magnitude of $0.00045726 \text{ ms}^{-1}$ is _____



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11. when the jaws of a standard vernier calipers are closed if the n th division of the vernier scale coincides with the n th M.S.D the zero error is _____



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12. The least count of a Screw gauge having 1 mm pitch and 100 circular scale divisions is _____ μm .



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13. The least count of a vernier calipers having 20 vernier divisions when 1 M.S.D. = 0.1 cm is _____ cm.



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14. Given the specific gravity of gold as 19 the mass of 100 cm volume of gold is _____ kg



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15. Match items in Column A with these in Column B.

Match items in Column A with these in Column B.

| Column A | | Column B | |
|----------|--|----------|--|
|----------|--|----------|--|

- | | | |
|------------------------------------|-----|--|
| A. Positive zero error | () | a. Ratio |
| B. Density | () | b. Significant figures = 2 |
| C. Least count of vernier calipers | () | c. Pitch per C.S.D. |
| D. Density | () | d. (V.C.D.) x (L. C.) |
| E. 2.200 | () | e. Zero of the circular scale above the index line |
| F. Momentum | () | f. 1 M.S.D. per vernier division |
| G. Relative Density | () | g. Significant figures = 4 |

| | | |
|---------------------------------|-----|--|
| H. Negative zero error | () | h. Kg m^{-3} |
| I. 2200 | () | i. $[\text{M}^1\text{L}^{-3}\text{T}^0]$ |
| J. Least count of a screw gauge | () | j. $[\text{M}^1\text{L}^1\text{T}^{-1}]$ |



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16. If the conductance of a conductor (G) is $\frac{I^2 t}{W}$ where I is current t is time and w is work done then the unit of conductance expressed in terms of fundamental units is _____

- A. $\frac{A^2 s^3}{kg^2 m}$
- B. $\frac{A^2 s^3}{kg^{-2} m}$
- C. $\frac{A^2 s^3}{kg m^2}$
- D. $\frac{A^2 s^3}{kg^2 m^{-2}}$

Answer: C



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17. The length of one main scale division of a given vernier calipers is 1 cm . When the jaws are in contact the last division of the vernier scale coincides with 99 th mark of the main scale. Then the least count of the calpers is _____

A. 0.01 mm

B. 0.01 cm

C. 0.1 cm

D. 0.1 mm

Answer: D



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18. The sensitivity of a physical balance is increased by the use of _____

A. knife edges

B. leveling screws

C. plumb line

D. light pans

Answer: A



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19. In a simple pendulum experiment the percentage errors in the measurement of g and l are $\alpha\%$ and $\beta\%$ respectively then the maximum error in measuring T will be

A. $\frac{1}{2}(\alpha + \beta)\%$

B. $\frac{1}{2}(\alpha - \beta) \%$

C. $\frac{1}{2}(\beta - \alpha) \%$

D. $2(\beta - \alpha) \%$

Answer: A



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20. The least count of a vernier calipers is 0.025 mm . If the 12th division of the vernier scale coincides with a main scale division and the zero of the vernier scale is to the right of

the zero of the main scale then the zero error is _____

A. $+0.3\text{cm}$

B. $+0.03$

C. $+0.12\text{mm}$

D. None of the above

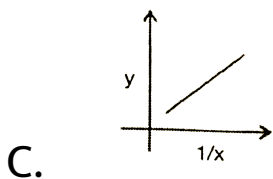
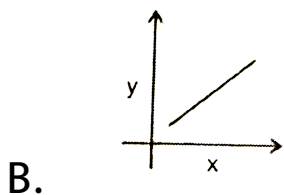
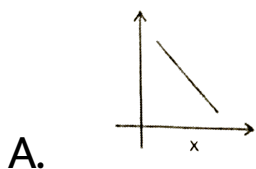
Answer: D



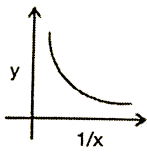
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21. Two variables x and y vary such that $xy =$ constant.

Which of the following graphs represent the above relationship ?



D.



Answer: C



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22. The difference between ZRP and HRP of a physical balance when 47.86 g of a substance is placed in its pans is 3. When 10 mg is added in its pans the difference between HRP and LRP is obtained as 5. The most accurate mass of the body is _____ g.

A. 47.875

B. 47.845

C. 47.866

D. 47.854

Answer: C



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23. if 17 divisions of the circular scale of a screw gauge are below the index line of the

pitch scale then the zero error is _____
circular divisions.

A. 17

B. -17

C. 83

D. 34

Answer: A



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24. which of the following measurements is most precise ?

A. 5 cm

B. 5.00 cm

C. 5.000 cm

D. 5.00000 cm

Answer: D



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25. the length and breadth of a rectangle wire measured using an instrument and the area was determined as 28.83 cm^2 . The instrument used could be _____

A. a vernier caliper whose least count is 0.1

mm

B. a metre scale

C. a vernier caliper whose least count is 0.3

mm

D. None of the above

Answer: B



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26. The time period of two pendulums of same length oscillating on different planets A and B is 2 s and 3 s, respectively . The ratio of acceleration due to gravity on the two planets is _____

A. 9 : 4

B. 3 : 2

C. 2: 3

D. 4: 9

Answer: A



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27. If the zero error correction of a screw gauge with least of count 0.01 mm is +0.05 mm

A. The number of C.S.D is 100 and the zero of the circular scale is 5 divisions above the index line.

B. The number of C.S.D is 100 and the zero of the circular scale is 5 divisions below the index line.

C. the number of C.S.D. Is 50 and the zero of the circular scale is 5 divisions above the index line.

D. Both (1) and (3)

Answer: D



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28. if a graphs is plotted between the length of a pendulum (l) and its time period (T) then the two guanttities are plotted as _____

(A) l along X-axis

(B) T along Y-axis

A. olny (A) is true

B. only (B) is true

C. both (A) and (B) are true

D. both (A) and (B) are false

Answer: C



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29. to construct a seconds pendulum having a length of 100 cm the value of g should be ?

A. $\pi m s^{-2}$

B. $100\pi m s^{-2}$

C. $\frac{1}{\pi^2}ms^{-2}$

D. π^2ms^{-2}

Answer: D



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30. When the jaws of a vernier calipers are in contact the eight division of the vernier scale coincides with the seventh division of the main scale . If N is the number of division on

the vernier scale and least count x then the zero error corrections is

A. $-8x$

B. $(N - 8)$

C. $(N - 8)x$

D. $+8x$

Answer: B



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31. The percentage errors in the measurement of the length (L) and breadth (B) of a rectangle are 1% and $b\%$ respectively. Then the percentage error in the calculation of the area will be _____

A. $(lb) \%$

B. $(1 + b) \%$

C. $(L + 1)(B + b)$

D. $Lb + BL$

Answer: B



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32. The least count of a vernier calipers is 0.01 cm and if the zero mark of the vernier scale is right of zero of the main scale and the vernier coincidence is 7 when the jaws are in contact then the zero error is _____ cm.

A. $+6 \times 0.01$

B. $+7 \times 0.01$

C. -7×0.01

D. -6×0.01

Answer: B



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33. the thimble of a screw gauge has 50 divisions .The spindle advances 1 mm when the screw is turned through two revolutions .
Then the pitch of the screw is _____

A. 0.5 cm

B. 0.15 cm

C. 0.5 mm

D. 0.01 mm

Answer: B



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34. The ZRP of a physical balance is 10.5 while finding mass of a substance .for a weight 34.23 g the resting point was found be 8.5 when 10 mg was removed the resting point was 11.0 .

The most accurate mass of the substance is
_____ g.

A. 34.15

B. 34.31

C. 34.238

D. 34.222

Answer: D



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35. The smallest weight that can be measured accurately using a physical balance is _____ g (grams).

A. 10

B. 0.001

C. 0.1

D. 0.01

Answer: B



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36. A vernier calipers and a screw gauge have the same least count and zero error with the difference that the vernier calipers has positive zero error and the screw gauge has negative zero error. The number of circular scale divisions on the screw gauge is twice the number of vernier scale divisions on the vernier calipers and the pitch of the screw gauge is 1mm.

If the vernier coinciding division and the circular are 3 and 97, respectively then find the

number of vernier scale divisions on the vernier calipers.

A. 10

B. 200

C. 50

D. 100

Answer: B



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37. A screw gauge has as many circular scale divisions as there are threads in 5 cm length of the screw . If the pitch of the screw is 0.5 mm then what is its least count ?

A. 0.001 mm

B. 0.001 cm

C. 0.0005 mm

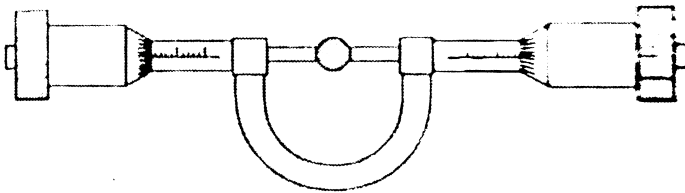
D. 0.0005 cm

Answer:



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38. A combined double screw gauge as shown in the figure is used as



If the readings on the two scales with the tips of the screws touching each other are 2.97 mm and 6.04 mm when a rod is held between the screws readings are 12.55 mm and 5.96 mm what is the diameter of the rod ?

A. 9.5 mm

B. 9.6 mm

C. 9.58 mm

D. Not possible to determine

Answer: D



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39. The least counts of a vernier calipers and a screw gauge are in the ratio of 5:1 . The main scales of both the instruments are marked in

mm. The zero error on the vernier calipers is $+0.15\text{mm}$ where as that on screw gauge is -0.06 mm . If the diameter of a rod lies between 0.9 cm and 1.0 cm and x and y are the VCD and CSR on the two instruments relation between x and y given that the number of C.S.D = 100 is

A. $x - 5y = 9$

B. $5x - y = 9$

C. $x - 5y = 21$

D. $5x - y = 21$

Answer: A



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40. The mass of a certain amount of salt determined by two different persons was found to differ by 200 mg. One using the left pan for the weights and the other using the right pan. Which of the following statement is false?

A. There is a zero error in the balance

B. The true mass of is the mean of the two weighings

C. The true mass is 100 mg less than the higher value.

D. The true mass is 200 mg more than the lower value.

Answer: D



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41. The lengths of two simple pendula are in the ratio of 2:3 and the ratio of the acceleration due to gravity at the two places where they are set up is 3:2 . The ratio of their frequencies is

A. 3:2

B. 4:9

C. 9:4

D. 2:3

Answer: D



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42. Pendulum A is x cm shorter than a seconds pendulum and pendulum B is x cm longer than the seconds pendulum . The ratio of their time periods is $3:4$. The length of the pendulum with higher frequency is

A. 86 cm

B. 114 cm

C. 128 cm

D. 72 cm

Answer: A



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43. If surface tension is defined as force per unit length which of the following quantities will have the same units as surface tension ?

A. W or $k \times \text{volume} \times \text{speed}$

B.
$$\frac{\text{Work} \times \text{velocity}}{\text{volume}}$$

C. $\frac{\text{work} \times \text{velocity}}{\text{rate of change of volume}}$

D. $\frac{\text{work}}{\text{time}} \times \frac{\text{volume}}{\text{velocity}}$

Answer: D



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44. If the each of the units of force velocity and frequency are doubled how many times has the unit of mass become ?

A. doubled

B. four times

C. halved

D. one-fourth

Answer: C



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Level 2

1. The dimensional formula of a physical quantity is known to be $[M^1L^2T^{-3}]$. Write

down the units of this quantity in C.G.S and S.I. units and calculate the multiplication factor for conversion from S.I. to C.G.S units.



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2. The pitch of a screw gauge is 0.5 mm and the number of division on the circular scale is 100. When a glass plate is held between the studs of the screw gauge , the main scale reads 1.5 mm and the 69th division of the circular scale coincides with the index line of

the main scale . What is the thickness of the glass plate ?



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3. A specific gravity bottle weight 10 g when it is empty . It weights 100 g and 110 g when filled with an oil and water respectively, .What is the relative density of oil ?



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4. A vernier scale has 10 divisions . It slides over a main scale whose pitch is 1.0 mm . If the number of division on the main scale , to the left- hand side of zero of the vernier scale is 4 and the 8th vernier scale division coincides with the main scale find the measurement.



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5. The fundamental frequency of a stationary wave formed in a stretched wire is

$n = \frac{1}{2l} \sqrt{\frac{T}{m}}$ where l is length of the vibrating wire 'T' is the tension in the wire and 'm' is its mass per unit length . If the percentage error in measurement of l T and m are $a\%$, $b\%$ and $c\%$ respectively then find the maximum error in measuring n .



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6. A vernier scale with 10 divisions slides over a main scale whose pitch is 0.5 mm (pitch =1M.S.D) . If a bob of diameter 9.75 mm is held

between the jaws determine the MSR and V.S.D . If

(a) there is no zero error

(b) the zero error= 0.35 mm



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7. When the tip of the screw of a screw gauge is in contact with the stud the zero of the circular scale is 3 divisions below the index line. To hold a wire the thimble is given a little over 3 rotations in the anti-clockwise direction

and with wire held tightly the 32nd division of the circular scale is now in line with the base line. The pitch of the screw is 0.5 mm and the number of divisions on the circular scale are 100. Find the correct diameter of the wire.



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8. A simple pendulum designed on the moon as a seconds pendulum is taken to a planet where the acceleration due to gravity on the surface is twice that on the Earth . If

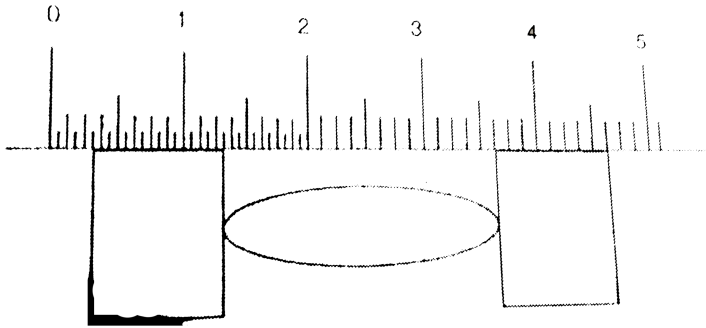
$g_{\text{earth}} : g_{\text{moon}} = 6:1$ find the period of oscillation of the pendulum on the planet mentioned above.



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9. In the figure given above the main scale is marked in inches .Determine the length of the object held between the two blocks . If 1 inch

=2.54 cm ,find the length in cm.



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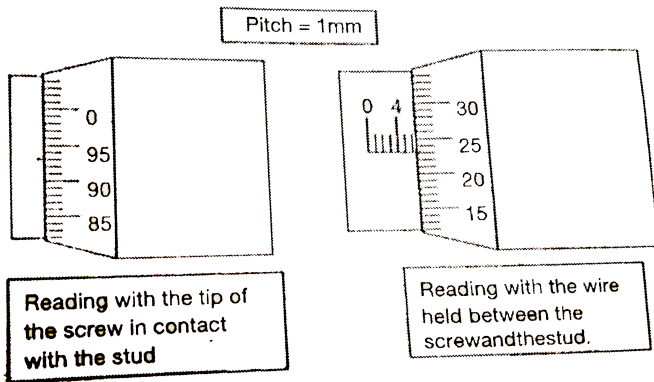
10. find the ratio of the relative densities of two substances if their masses are equal when the volume of one is $11/2$ times that of the other ,





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11. Find the area of cross-section of a rod the diameter of which is measured with a screw gauge with readings as shown in the figure



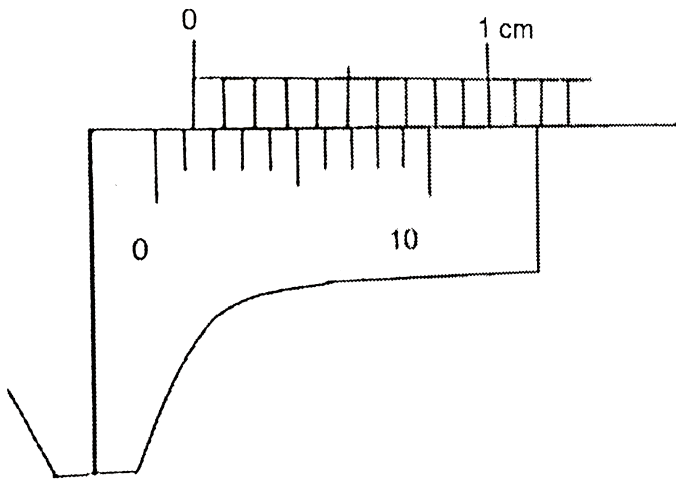
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12. The working of a common balance or a physical balance is based on the 'Principle of moments'. A metre scale of uniform density is balanced at the centre. If a mass of 2 kg is suspended at an edge of the scale then what mass should be suspended on other side at $\frac{1}{4}$ th length of the scale to maintain the horizontal position of the scale ?



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13. Determine the least count and the zero error of the vernier calipers shown in the figure below . What is the corresponding zero correction?



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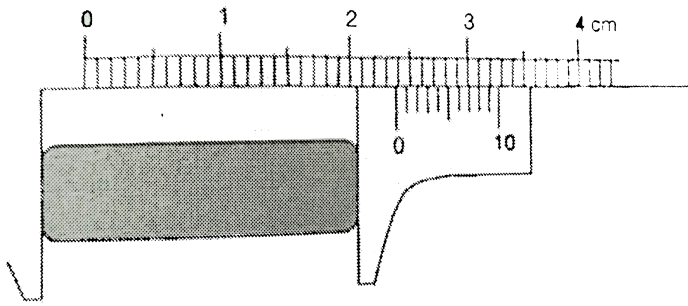
14. A pendulum clock in a museum was found to lose 1 minute in every 24 hours . What corrective measure should the curator of the museum undertake ?



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15. the corrected length of a rod when measured with the help of a vernier calipers is 25.4 mm

(Refer the figure below)



Determine the zero error.

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16. The following are the values known in a particular measurement 30.56 , 12.6 , 21.09.

What is the sum of the values when rounded off to one decimal point?



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17. What is the dimensional formula of (a) volume (b) density and (c) universal gravitational constant 'G' . The gravitational force of attraction between two objects of masses m_1 and m_2 separated by a distance d is

given by
$$F = \frac{Gm_1m_2}{d^2}$$

Where G is the universal gravitational constant.



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18. The distance travelled by a body in different time intervals is tabulated as follows

. Draw the distance time graphs.

| | | | | | |
|------------------|---|----|----|-----|-----|
| Time (s) | 0 | 10 | 20 | 30 | 40 |
| Distance (m) | 0 | 40 | 80 | 120 | 160 |



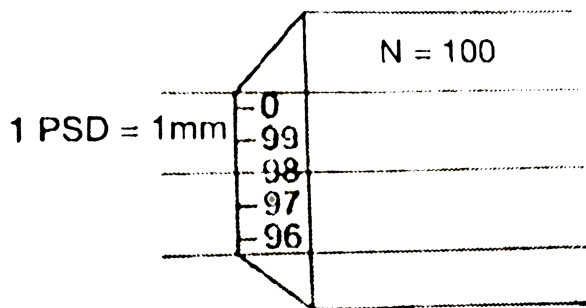
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19. 1 yotta meter is how many kilometer ?



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20. When the studs of a screw gauge are in contact the position of the head of the screw is as shown below Determine the zero error,



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21. Name the part of the physical balance which is used to increase its sensitivity



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22. The ZRP of a physical balance is 10.5 while finding mass of a substance .for a weight 34.23 g the resting point was found be 8.5 when 10 mg was removed the resting point was 11.0 . The most accurate mass of the substance is _____ g.





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23. If the units of mass length and time are doubled then what happens to the unit of relative density , ? Discuss.



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24. An irregular solid when immersed in water displaces $\frac{3}{4}$ th litre of water. When immersed in a given liquid it displaces 600 g of the liquid . What is the density of the liquid ?



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Level 3

1. The dimensional formula of a physical quantity x is $[M^1 L^2 T^{-2}]$ and that of another quantity y is $[M^1 L^1 T^{-1}]$. If a third quantity z is directly proportional to the square of y and inversely proportional to x then find the dimensional formula of z .



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2. A simple pendulum is completely submerged under water . Discuss the variation in its time period.



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3. The purpose of plumb line in a physical balance and in the hands of a mason is same . If so what is that purpose ? If it is absent in a physical balance what happens to the mass of a body measured in the balance



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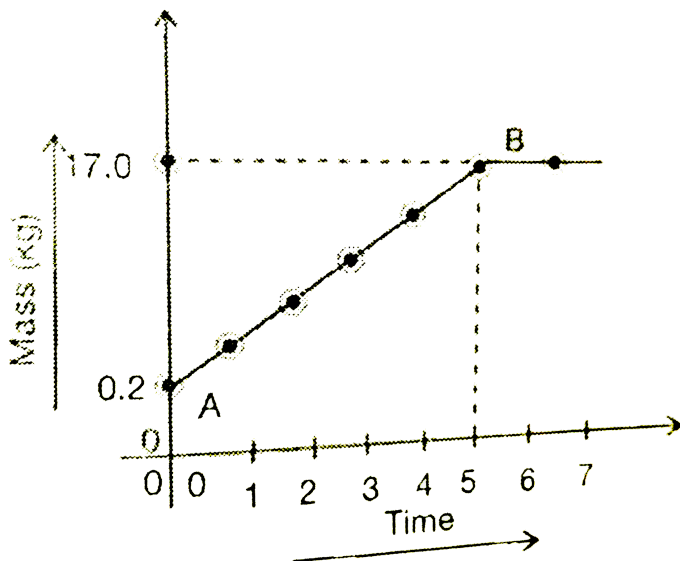
4. A liquid flows into a vessel initially empty at a steady rate of $70 \text{ cm}^3 \text{ s}^{-1}$. The pictorial representation (graph) of the increase in the mass of the vessel with time is given below.

(i) What does the point A represent ?

(ii) What does the horizontal line beyond B indicate ?

(iii) find the capacity of the vessel.

(iv) Find the density of the liquid .



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5. The distance between two consecutive threads on the screw of a screw gauge is 0.5 mm. The number of divisions on the circular

scale is 100. a wire is placed between of the studs of the screw gauge. Find the diameter of the wire if the pitch scale shows 14th division and 40th circular division coincides with the base line.

The given apparatus was detected to have negative zero error. The 90th division on the circular scale of coincides with reference line, when the studs are in contact.



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6. The divisions on the main scale of a screw gauge are 1 mm apart and the screw of the spindle advances by 5 main scale divisions when the spindle is given 5 complete rotations . How many divisions are to be provided on the circular scale for the least count of the instrument is to be $1 \mu m$? What changes are required of the number of divisions can be only 500 for the same least count?



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7. A vernier scale with 10 divisions slides over a main scale whose pitch is 0.5 mm (pitch = 1 M.S.D) . If a bob of diameter 9.75 mm is held between the jaws determine the MSR and V.S.D . If

(a) there is no zero error

(b) the zero error = 0.35 mm



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8. Using a screw gauge without any zero error the diameter of a wire determine as 2.74 mm .

If the screw advances 5 mm when the thimble is given 10 complete rotations what are the possible values of the pitch scale reading circular scale reading and the least count if N is the number of head scale divisions?



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